of embryonal cartilage; or, that they may, on absorption of the basement-substance, change their shape and size; or, that they may undergo active proliferation, and take part directly in the formation of young forms of connective tissue, similar to those produced by cells from other sources. They show, furthermore, that bits of cartilage in which the cells are killed before transplantation, may be entirely absorbed by means of cells and bloodvessels from the young connective tissue which encapsulates them; and that this same process of external absorption occurs hand in hand with the internal absorption in fragments whose cells are transplanted alive.

It will be seen by reference to the literature of this subject, which is already extensive, and upon which it is not the purpose of the writer to enter here, that these results do not reveal any special capacities in cartilage-cells which have not been already assumed by investigators of this theme; but as these studies have been heretofore largely confined to natural pathological changes, or, when experimental, have been usually incapable of such definite control and variation, the above series of experiments seem worthy of record, especially on account of the greater certainty which they impart to the assumption of the capacity of cartilage-cells under changed conditions, to participate directly in the formation of other forms of tissue. The bearing of this upon the question of the production of new cells in inflammation, after what was said at the commencement of this article, is sufficiently obvious without further remark.

Absorption pictures similar to some of those described above not only are frequently seen and have been repeatedly described and figured in some of the ordinary diseases of cartilage, but are common, and often extremely puzzling, in certain of the complex tumours of the parotid and submaxillary glands.

ARTICLE V.

OPENING AND DRAINAGE OF CAVITIES IN THE LUNGS.[1]

By CHRISTIAN FENGER, M.D., and J. H. HOLLISTER, M.D., of Chicago, Illinois.

IT is only a little more than a decade since Professor Mosler, of Greifswald in Germany, conceived the brilliant idea of combating cavities in the interior of the lung by surgical means. It was natural that the consumptive cavity, being the most common in the lungs, and the variety which offered the most desperate resistance to medical treatment, should be the first selected for a trial, for the following reasons:—

I. The superficial wall of such cavities was known to be adherent, in most cases, to the wall of the chest; consequently the cavity could be opened without much danger of opening the pleural cavity, and thereby causing a fatal pyo-pneumothorax.

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[1] Read before the Minnesota State Medical Society, June 20, 1881.

II. It was believed by a large part of the profession that infection of the still healthy lung-tissue was caused by aspiration of the liquefied cheesy matter contained in the consumptive cavities, and this, when brought in contact with still healthy bronchial tubes, would cause endo-bronchitis and peri-bronchitis, which were shown by Virchow to be among the most common features in the consumptive destruction of lung-tissue.

Mosler opened and drained a superficial consumptive cavity, using a silver drainage-tube. The result, however, did not fulfil the expectations. The patient died in due time from the pulmonary consumption, which had progressed notwithstanding the operation. As a consequence of this, the surgical treatment of consumptive cavities was abandoned, to remain in the history of medical science only as an interesting experiment.

But although Mosler's operation was of no avail in the treatment of pulmonary consumption, it accomplished this much good, that it called the attention of the profession to the surgical treatment of cavities in the lungs, and demonstrated that such cavities might be opened and drained without any of the dangers or inconveniences which, from *à priori* reasoning regarding a hitherto untried surgical procedure, might be expected to arise.

The next step in the surgery of the lungs was to attack less malignantly destructive pathological processes, which, as we know from observation of like processes in other tissues of the body, may terminate in recovery. These processes include suppuration and gangrene of lung-tissue, in other words, abscesses and pulmonary gangrene.

Cavities arising from acute pathological processes in the lung-tissue, naturally present themselves as objects for surgical treatment, when the anatomical conditions, that is, the position of the cavity, make such treatment possible, for the following reasons :—

There is, in the nature of these two pathological processes, nothing absolutely fatal, nothing necessarily progressive, as in tuberculosis, when this has developed so far as to form a large cavity. When the contents of a gangrenous or abscess cavity are entirely removed, there remains in the walls of the cavity no disease of the tissues which should necessarily prevent the closure of the cavity. This has been demonstrated by a number of cases of this kind, in which spontaneous recovery has taken place by evacuation of the contents of the cavity through the bronchial tubes.

But in spite of the possibility of spontaneous recovery, which in pulmonary gangrene rarely occurs, but is somewhat more common in abscesses, a number of cases remain, in which the size and progressive enlargement of the cavity and the gradual failing of the patient's strength, enable us to determine, a considerable time before death, that a fatal result is inevitable, and it is in such cases that we are tempted and have the right to claim assistance by means of surgical interference, for the following reason :—

The decomposing contents of such cavities, whether gangrenous fluid or ichorous pus, causes the progressive destruction of the lung-tissue *in loco*, namely, the increase in size of the cavities, as well as the general poisoning of the organism by absorption, with rise in temperature and decrease in strength. Besides this, the poisonous contents of the cavities are apt at any time, by aspiration through the bronchial tubes, to give rise to purulent bronchitis, broncho-pneumonia, or pleurisy in distant parts of the lungs. Any of these complications may at any time cause a sudden fatal termination before the time at which the gangrene or pulmonary abscess would come to its natural termination by exhaustion.

From the above considerations we are justified in desiring and attempting to evacuate the contents of such cavities, and in so doing, to expect not only to arrest the progress of the disease and avoid the complications from distant parts of the lungs, but also to cause the closure of the cavities so as to effect a definite cure.

The number of cases of acute cavities in the lungs in which surgical interference has been resorted to is as yet very limited, only six cases having been reported, and these within the last three years. Of these six cases only one, our own case, was successful, in so far that it terminated in a complete recovery.

But even from some of the cases that terminated fatally it was seen that immediate relief and temporary improvement in the patient's condition followed the operation to such an extent that the attention of the medical profession was drawn to the subject, and justifiable encouragement was given to further trials.

The importance of the subject warrants the report in detail of the cases, which we shall give as minutely as we are able, and, having done this, we shall discuss as far as possible the most important aspects of the question.

The first two cases, on account of the imperfect reports, but with the diagnosis confirmed by the autopsy, only show that the surgical evacuation of the contents of the cavities gave considerable relief to the patients, and in the second case this relief lasted so long that recovery was fully expected.

Case I. *Large Abscess of the Lower Lobe of the Right Lung.—Incision in the mammary region—Washing out of the cavity—Immediate relief—Acute pleurisy on the opposite side—Death twenty-nine hours after the operation.* (Radek, 1878, *Centralblatt für Chirurgie*, No. 44, 1878, p. 750.)—A man, forty-four years of age, was brought into the hospital suffering from great dyspnœa. Examination showed two large fluctuating abscesses in the neighbourhood of the right nipple. Pressure over the abscess-cavities showed that they communicated with each other, and caused increased dyspnœa and cough, which brought up a quantity of pus. The diagnosis was supposed to be an empyema which was about to open through the walls of the chest, and had already broken into the lung.

An incision was made, through which about a quart of pus was evacuated. The cavity was washed out with carbolized water, and the patient experienced immediate relief. On the following day, however, twelve hours after the operation, the fever set in anew, and the physical examination showed that a pleurisy was commencing in the left lung. The patient died twenty-nine hours after the operation. The autopsy showed no empyema, but a very large abscess of the lower lobe of the right lung and a recent pleurisy on the left side.

This case came under treatment at so late a stage of the disease that it has no value as regards diagnosis and the method of operation. It shows, however, that the operation was followed by some relief, and did not in any way hasten the fatal termination, but was performed too late to prevent it.

Case II. *Large Abscess in Lower Lobe of Left Lung.—Fetid expectoration—Insufficient drainage through the bronchial tubes—Incision in sixth intercostal space—Drainage and washing out with carbolized water—Marked improvement for twenty-six days—Sudden and unexpected death on the thirty-first day—Cause of death not given.* (R. S. Sutton, Pittsburgh, Pa., 1879, *Chicago Medical Review*, March 5, 1881, p. 112.)—Early in 1879 I was called to see a Bavarian, aged thirty-four, who was much emaciated, but presented the appearance of having been a very powerful man. The patient had a hoarse voice and a rapid pulse, his temperature on further examination being found slightly above the normal. He had had, five years before, a violent attack of pneumonia, from which he had never entirely recovered, but, although for a time somewhat better than during the pneumonia, his general health had become much worse than it had been prior to the attack. Two years subsequent to the pneumonia he had three attacks of hæmoptysis, a year after which, symptoms of acute pleurisy made their appearance on the left side. At the present time the patient has much cough and a muco-purulent expectoration. On physical examination the right lung is apparently normal. There is a total absence of vesicular respiration on the left side, gurgling, increased on coughing, being present at the same time; there is complete dulness on percussion while the patient remains sitting. On the patient's assuming a recumbent posture, succussion showed a decided metallic tinkling. The recumbent position provoked cough, with increased expectoration, having a foul odour. The patient was informed that his case was one of doubtful prognosis, and thereupon left further procedure to the physician. The day following the examination just mentioned I visited the patient in company with Dr. Geo. Rohansen, fully prepared to operate. To determine the correctness of the diagnosis of the supposed cavity, the lung was aspirated, giving vent to quite a quantity of ill-odoured pus. A bistoury was plunged into the lung at the sixth intercostal space, giving vent to quite a quantity of foul, purulent material, which was ejected with some force when the patient coughed. Two large-sized Nélaton's catheters were passed into the cavity through the opening and secured by adhesive plaster, at the margins of the wound; carbolized distilled water at a temperature of 100° F. was projected, by means of a Davidson's syringe, through one of the catheters, passing out through the other. The patient experienced the odour of carbolic acid at its first injection. The cavity was washed out daily for a month, the patient being well fed. He was able to be up and about for twenty-six days, aad was apparently on a fair road to recovery, when he died suddenly on the thirty-first day. At the autopsy an abscess was found involving the entire lower lobe of the left lung. The pleura pneumonalis and costalis were glued together. An enlarged bronchial tube led from the abscess to the trachea.

This case, although so superficially reported that it does not furnish any tangible points for the differential diagnosis between empyema and pulmonary abscess, has considerably more interest than Radek's case, because it shows—the diagnosis being confirmed by the autopsy—that a large pulmonary abscess was opened, drained, and washed out, with unmistakable relief, and that the effects were so beneficial that the patient seemed, for thirty days, to be in a fair way to recover. The autopsy, valuable as to the confirmation of the diagnosis of pulmonary abscess, failed to demonstrate the cause of the patient's death, and consequently the importance of the case is limited to the immediate consequences of the operation.

The following cases have considerably more interest, partly because the diagnosis was carefully made before the operation, and partly because the main feature in the indications in all these cases was, by the operation, to evacuate fetid or gangrenous matter from pulmonary cavities having insufficient outlets through the bronchial tubes, and where consequently the remaining fetid matter produced symptoms of general poisoning by absorption, as fever, collapse, etc., as well as poisoning of the rest of the lungs, in the shape of diffuse fetid bronchitis. In all of these cases except one, the operation was followed by decided relief, temporary in two cases, and permanent in our own.

CASE III. *Multiple Fetid Abscesses in lower Lobe of Right Lung, subsequent to Bronchitis and Pleuro-pneumonia.—Hectic diarrhœa—Insufficient outlet through the bronchi—Incision in eighth intercostal space, mid-scapular line—Drainage and washing out with Condy's fluid—Temporary cessation of cough and fetor for three weeks—Insufficient drainage—Return of fetor—Pleuro-pneumonia on the opposite side—Death fifty days after the operation.* (W. Douglas Powell and R. W. Lyall, London, England, 1879; *Lancet*, vol. ii. No. 1, 1880, p. 12.)—A man, forty-nine years of age, had bronchitis in December, 1878, and in February, 1879, a pleuro-pneumonia and fetid expectoration. He improved for a time, but then suffered a relapse. In July, 1879, he entered Middlesex Hospital. On admission there was consolidation of the lower lobe of the right lung, with excavation of its central portion, the cavity signs being located at about the level of the spine of the seventh dorsal vertebra, and in line with the angle of the scapula. There were considerable hectic, diarrhœa, and anorexia. The breath and expectoration were extremely fetid, the latter being muco-purulent in character and very abundant, amounting to about one pint in twenty-four hours.

The area of excavation having been carefully marked out, the operation was performed September 11th. A medium-sized trocar was first passed in at the eighth intercostal space, mid-scapular line, and, a free incision having been made through the tissues down to the intercostal muscles, the fine trocar was withdrawn and a full-sized hydrocele trocar inserted to enlarge the opening, through which the drainage-tube was afterwards inserted. Carbolized dressings were then applied. A moderate quantity of fetid pus escaped from the wound, and subsequently a free but never abundant discharge from the drainage-tube.

The expectoration and cough almost entirely ceased. The wound was dressed daily under the carbolic spray, and injections of Condy's permanganate of potash solution were used. October 2d. There was some return of the fetor of breath, the discharge from the tube having always been somewhat fetid. Some trouble was occasioned by the drainage-tube getting out, its re-introduction being rendered more difficult by encroaching granulations, and the tube was felt to strike against some impediment deep in the lung. The channel was kept dilated, however, and the patient improved in strength, and on October 20th, was transferred to Brompton Hospital. The fetid sputa returned toward the end of the month, however; the amount expectorated also continued to be very scanty. The patient lost ground rapidly, and was finally attacked by pleuro-pneumonia on the opposite side, from which he died October 31st, fifty days after the operation.

The autopsy demonstrated several inter-communicating cavities in the lower lobe of the right lung. This lobe was firmly adherent throughout, and a drainage-tube passing through the eighth intercostal space entered the contracted cavity, which was connected with the main cavity by a short, dilated bronchus. It was evident that, in contracting upon the tube, the wall of the cavity partially occluded its extremity. The remainder of the lobe was consolidated by fibroid interstitial pneumonia, surrounding bronchiectatic cavities. There was broncho-pneumonia with effusion on the left side. The rest of the lung was emphysematous.

Besides the very remarkable relief derived from the operation, this case is mainly interesting because it shows that the insufficient drainage and evacuation was evidently the reason why the latter failed to save the patient's life. And it was here, as in Radek's case, the poisoning of the other lung from the decomposed contents of the cavity which, resulting in a pleuro-pneumonia, caused the patient's death. In short, we may say that the patient died notwithstanding the operation, on account of the perhaps inevitable insufficiency of the operation, but by no means from any reason for which the operation itself could be held accountable.

A similar condition probably existed in Williams's case, which is mentioned only very briefly, too briefly to allow either deductions or criticisms, but which, for the sake of completeness, we shall mention.

CASE IV. (Williams, London, England, 1879, *Lancet*, vol. ii. No. 1, 1880, p. 12.)—Dr. Williams briefly mentions that in one case he passed an aspirator needle into a bronchiectatic cavity without result. On a second tapping, however, he succeeded in evacuating the contents of a limited empyema, which, he thinks, may have been caused by the previous paracentesis.

It is easily seen that in Williams's case it is difficult to determine whether the entire want of success of the operation was due to avoidable inefficiency in the method of operating or to the unavoidable surgical intractability of bronchiectatic cavities in general. Such cavities, on account of their well-known irregularly sacculated and often ramified shape, present very great, if not insurmountable difficulties for effective surgical interference.

The following case is very interesting, because it presents, notwithstanding the want of an autopsy, a clear case of acute pulmonary gangrene subsequent to a croupous pneumonia. The description of the case, as well from the etiology as from the careful description of the development and physical signs, leaves no doubt as to the correctness of the diagnosis. It is probably the first, if not the only case of pulmonary gangrene treated by surgical operation, which, as far as temporary relief is concerned, may be accounted a success.

CASE V. *Gangrenous Cavity in Middle Lobe of Right Lung subsequent to Croupous Pneumonia.—Insufficient outlet through the bronchi—Adynamic condition of patient—Incision in the region of the angle of the scapula—Drainage with injections of carbolized water—Decided improvement for a week—Cessation of fetor of breath and expectoration—Return of fetid expectoration—Collapse and death twelve days after the operation.* (Solomon Charles Smith, Halifax, England, 1879, *Lancet*, vol. ii. No. 3, 1880, p. 86.)—The patient, a man about sixty years of age, had always been in good health, until two months previous to the operation, during which time he had had a little shortness of breath on going up hill. Two weeks previous to the operation he had a sudden attack of pneumonia of the right side, with chills, pain in the right side, pneumonic crepitus and rusty sputum. The case was not very severe, the temperature never exceeding 102°, and in about a week he got up. Two days later, the cough became worse, he felt weak, had to go to bed, and his breath had an offensive odour.

October 13, he suddenly expectorated half a pint of fetid gray fluid, and sank rapidly into a condition of collapse. On the next day, the patient was covered with clammy perspiration, his respiration was rapid and difficult, with loud tracheal râles; pulse 130, very feeble; could not lie down on account of the cough. The air of the whole room was extremely offensive on account of the gangrenous odour of breath and expectoration. The matter expectorated was principally a thick, tenacious, muco-purulent mass, but frequently alternating with this, was a thin, gray, offensive fluid, which seemed to gush into his throat suddenly, in such quantity that he would spit out mouthful after mouthful of about half an ounce each, for three or four times in succession. The right side was slightly less resonant than the left, especially at the base, and at and under the right nipple. There was less respiratory sound on the right side and less local vibration, but all the sounds were greatly masked by tracheal râles; he had no pain; the tongue was brownish-black and dry, and the patient was very weak. Under invigorating and stimulating treatment he seemed to improve a little for a day or two, but then the expectoration diminished and he became worse. Four days later, a quantity of the same fetid fluid as before was expectorated, and he felt a little relieved, but soon afterward the expectoration stopped again and the adynamic condition of the patient increased.

On October 20, distinct cavernous respiration was heard below the spine of the right scapula, and external to and below the right nipple. The diagnsois was now made of a large cavity extending chiefly through the middle lobe of the right lung, with no efficient outlet for the contained fetid matter, and a consequent adynamic condition of the patient from poisoning by the fetid pus. It was now resolved to operate, with a view toward procuring an outlet for the fetid matter, for the following reasons:—

I. That the actual condition of the patient made it certain that he would die, and that very speedily.

II. That there would be some chance for his life if the cavity could be found and an opening made.

III. That it would be justifiable to explore with an aspirator, and if the cavity was found, to enlarge the opening and put in a drainage-tube.

At a point near the angle of the scapula, an aspirator-needle was inserted for three or four inches. No fluid escaped, but very fetid air was drawn through the tube. On holding a candle near the canula, the flame was blown to and fro during respiration, so that evidently a cavity had been reached.

Using the canula as a director, a knife was inserted between the ribs, and by the side of the knife dressing forceps were slipped in and the wound enlarged sufficiently to allow the introduction of a small india-rubber tube. Through the latter, a little carbolic acid solution was injected. This seemed to occasion a fit of coughing, when about half a pint of fetid pus, of the same character as the former offensive expectoration, was forcibly expectorated. The tube was left in the wound, which was covered by a large pad of a dozen folds of coarse muslin, wrung out of a solution of carbolic acid. This dressing was ordered to be changed every three hours.

For the first week after the operation, the improvement was very decided. For six days, the expectoration was very much diminished. The fetor also became much less, except at the time when the dressing was changed. He enjoyed his food more, and was altogether more comfortable. The respiration became much clearer in the left lung and the unaffected parts of the right lung, the moist sounds being much less frequent, and the tracheal râles only occasional. The discharge from the wound, however, continued extremely offensive, notwithstanding the daily irrigation of the cavity by a siphon. Whenever the dressing was changed, it was found to be soaked with a discharge for an area of five to six inches in diameter. As the water which escaped on washing out the cavity was only slightly stained, the offensiveness was attributed not to any retention of pus, but rather to sloughing within the lung.

Eight days after the operation the discharge had lessened a good deal, but the expectoration now increased and again became offensive. The pulse increased to 112; temperature, 100°. On the next day he was better, in the morning, had less cough and expectoration, and took food well. But the wound was beginning to slough, and a few gangrenous black shreds were discharged through the drainage-tube. In the afternoon he became very ill, with laboured breathing, quick pulse, and profuse cold sweats. From this time he gradually became weaker, would take no more food, and died November 2, apparently from simple asthenia. An autopsy was not held.

Isolated as this case stands as an effort to evacuate the contents of an indisputably gangrenous lung cavity, it may be hazardous to venture any justifiable criticism upon the operation in the case in question, from which to deduce any conclusions showing that in such a case the patient's life might have been saved. But it is barely possible that, if an opening had also been made in the anterior wall of the cavity when the cavernous breathing presented itself round the nipple, that then more efficient and perhaps sufficient drainage, and an outlet for all the gangrenous matter, fluid as well as solid, might have been effected.

That a double, free, and extensive opening of similar pulmonary cavities, with thoroughly effective drainage, by no means involves any additional danger, but rather, when practicable, is liable to make it possible to save the patient's life, we claim to show by the following case.

CASE VI. *Large Fetid Abscess Cavity in Middle Lobe of Right Lung, caused by Suppuration around a Large Echinococcus Cyst, of twelve years' standing.—Fetor of breath and expectoration—Insufficient outlet through the bronchi—Diffuse purulent bronchitis in the rest of the right lung—Fever, emaciation, and collapse—Exploratory aspiration—Incision in third intercostal space on anterior surface, two inches to right of sternum—Digital exploration of the cavity—Counter opening in fifth intercostal space, anterior axillary line—Removal of the sac of the echinococcus cyst through the anterior opening—Drainage, by means of a large rubber tube—Washing out of the cavity with carbolic acid solution—Antiseptic dressing—Definite cessation of fetor of breath and expectoration—Wound closed in six weeks—In the seventh week, broncho-pneumonia of right lung, with diffuse purulent bronchitis of this and of the lower lobe of left lung, lasting four weeks—Perfect recovery.* (Christian Fenger, Chicago, 1880. *Chicago Medical Review*, vol. iii. No. 3, 1881, p. 57).—Francesco Coputo, Italian, a labourer, 34 years of age, was admitted to Cook County Hospital and placed under Dr. Hollister's care.

Previous History.—Father died at the age of 77; mother still living. He has one brother and one sister, who are in good health. He had always had good health until twelve years ago, at which time he was a mounted gendarme in Italy, and on duty from three to four hours consecutively. He had at this time a hemorrhage from the lungs of about two ounces, in consequence of which he was obliged to remain in the hospital a week. For the following two years he was well. After this time, he had a cough accompanied by pain around the right nipple. The pain subsided on the application of leeches; the cough also disappeared entirely after a month. In the following years he had every autumn a return of the pain, always at the same point in the chest, between the third and fifth ribs, and around the nipple, accompanied by cough. This would persist for about a month, be relieved by the use of leeches and venesection, and disappear entirely. During the last four years, however, the pain became more severe, as did also the accompanying cough. In the intervals between the attacks, he would occasionally feel some pain in the region of the right nipple, when lifting a heavy weight on the right shoulder.

He came to New York in 1878, where he stayed a year and a half. He was able to work all this time, except during the usual attacks of the pain and cough in the fall, during which he expectorated mucous matter, which occasionally was slightly streaked with blood. In June, 1880, he came to Chicago and commenced work as a common labourer. In September the pain in the left nipple set in again. It was a steady, unvarying, intense pain, accompanied by only a slight cough. His appetite remained good, and he did not go to bed, but was forced to cease work for two weeks. During October he was at work again. In November, he was obliged to stop work on account of a return of the pain and cough. He lost his appetite, became weak, was confined to his bed about half the time, and finally, three weeks before he entered the hospital, he was obliged to remain in bed all the time. During this time he had no appetite, was feverish, would cough up about a pint of mucous matter, sometimes streaked with blood, in twenty-four hours, and was distressed night and day by the cough, which he could subdue only by lying prone in bed. A cataplasm was applied to the chest, and some medicine given. Suddenly, about a week before his admission to the hospital, he coughed up a large quantity of whitish matter, as he says, "white like paper." This was not followed by relief of the pain or cough, which rather increased. He grew more and more weak, could not eat, was not able to sleep on account of the cough and pain, and was told by those about him that his breath was offensive, he himself not being able to detect this.

On Admission.—The patient was in a profuse perspiration; pulse 98; temperature 104°; respiration 36; tongue slightly coated. When he lies on the back, and the chest is percussed, he coughs incessantly, and a very offensive odour is noticed around the bed. When he lies prone on the right side, the cough ceases, and the offensive odour is not so marked.

Examination.—The patient is poorly nourished, tall, and of moderate weight.

Percussion.—When the patient is sitting up in bed, percussion on the right side, over the supra-clavicular and infra-clavicular regions is normal, but from the second rib, in the mammary and infra-mammary regions, the percussion is dull. There is also dull percussion in the axillary and infra-axillary regions, and over the scapular and inter-scapular regions. In the infra-scapular region, percussion is normal. When the patient lies on the back, there is an area of tympanitic percussion sound on the anterior side of the body, namely, in the mammary region.

Inspection.—Both sides of the chest participate equally in the respiratory movements. The right side of the chest is neither sunken nor prominent. The intercostal spaces have the same appearance on the right as on the left side.

Palpation.—In the region of the dull percussion, the pectoral fremitus is nearly but not quite absent.

Auscultation.—Over the right side of the chest. Sibilant râles in the upper lobe in the region of the clear percussion, and in the posterior part of the lower lobe. Over the regions of dull percussion, the respiratory sounds are obscure. When the patient lies down, auscultation over the tympanitic territories gives cavernous respiratory sounds.

A hypodermic needle was introduced near the right nipple by Dr. W. P. Verity, House Physician, while the patient was sitting up, and some fluid withdrawn, which was thin, grayish, and had the same offensive odour as the breath. On microscopical examination, this fluid was found to contain a large number of pus cells, with fatty detritus and bacteria.

Diagnosis.—Fetid cavity in the middle lobe of the right lung, nearer to the anterior surface, and most superficial at the nipple, having an insufficient outlet through a large bronchial tube in the anterior border of the cavity. Diffuse purulent bronchitis in the rest of the lung.

Five grains of quinia, every four hours, and whiskey sling were ordered.

December 22. The patient feels a little easier. When he is lying on the breast no offensive odour is perceptible. When he turns on the back, however, the breath becomes offensive, with an odour like rotten eggs, and cough sets in. In the morning the pulse was 84; temperature, 99° ; respiration 32. Evening, pulse 90; temperature 102° ; respiration 32.

For the next four days the patient remained in the same condition, having exacerbations of the fever at night, and lying prone on the right side in order to avoid the cough and offensive breathing.

26*th.* With the kind permission of Dr. Hollister, under whose care the patient was lying in the hospital, Dr. Fenger saw the patient and resolved to open and wash out the cavity. The reason for the operation was the following:—

As the large cavity in the anterior part of the lung had no sufficient outlet through the bronchial tubes, by which to evacuate its offensive contents, the poisonous character of which was indicated by the nightly exacerbations of fever and decrease in strength of the patient, it was deemed advisable to attempt to facilitate the evacuation.

Operation.—In the presence of Dr. Hollister, and assisted by the internes of the hospital, Dr. W. P. Verity, House Physician, and Drs. Gudden, McArthur, Bradley, Meacher, Kendall, and Bacon, Dr. Fenger operated in the following manner: The patient was anæsthetized with ether. An incision was made, two and one-half inches in length, in the third intercostal space, parallel with the ribs, commencing one and one-half inches to the right of the sternum, and one and one-half inches above the nipple. The tissues were divided until the intercostal muscles were laid bare. A detached hypodermic needle was introduced, and as neither inspiration nor expiration caused this to move, it was withdrawn, and the incision continued into the cavity. When this was opened, about half a pint of grayish-white offensive matter, intermixed with some air, escaped. The opening was then dilated sufficiently to allow the introduction of a finger into the cavity. By means of the finger soft, elastic lung tissue was felt below the opening; above, the roof of the cavity could not be reached; soft, elastic lung tissue could also be felt on the interior wall of the cavity, towards the mediastinum, and in the posterior wall of the cavity. In this latter locality the soft, elastic lung tissue decreased in thickness toward the anterior boundary of the axillary region, anterior to which the wall of the cavity was firm to the touch. At this point, namely, between the fifth and sixth ribs, close to the border of the pectoralis major, one and one-half inches to the right of and one and one-half inches above the right nipple, a counter-opening was made in the following manner: A urethral sound was passed in at the original opening, and cut down upon at the above-mentioned locality.

A heavy rubber draining-tube, ten millimetres in diameter, with large lateral openings, was now introduced at the anterior and brought out at the posterior opening. By means of an irrigator, a two and one-half per cent. solution of carbolic acid was injected through the drainage-tube into the cavity, which was washed out in this way. As soon as this solution filled up the cavity, the patient began to cough. Each paroxysm of coughing forced out from the anterior opening, at the side of the drainage-tube, a jet of fluid, which was thrown from eight to ten feet out into the room.

During these attacks of coughing it was noticed that a yellowish-white, coherent mass would appear at and protrude a little from the anterior opening, but would slip back and disappear as soon as the cough ceased. Dr. Fenger attempted to seize this with the forceps and draw it out, but it would break asunder and slip back. With a view to its removal, he now dilated the anterior opening a little, introduced a finger and the forceps, and watched for another attack of coughing, which enabled him to get hold of and draw it out as one large, gelatinous, coherent mass.

On microscopical examination of the gelatinous mass removed from the abscess cavity during the operation, it was found to be a large echinococcus cyst, the wall presenting the characteristic, finely striped, that is, laminated layers of amorphous or homogeneous substance, the stripes always running parallel to the surface of the wall of the cyst. The sac, as we here present it to the Society, will be seen to be nearly round, and between five and six inches in diameter. The wall was homogeneous, gelatinous, and transparent; soft and friable, but still somewhat elastic, and presented no secondary cysts, either attached to the wall or free in the cavity.

The cavity was now washed out with the carbolic acid solution until the escaping fluid was perfectly clear. The incision wounds were reduced in size by means of sutures, both ends of the drainage-tube were secured by large asepticized safety-pins, and cut off close to the skin, and the wounds dressed antiseptically, as follows :—

A piece of protective was placed over each wound, and a pad, two inches thick, consisting of antiseptic gauze, not in layers but in a wad, applied so as to cover the entire anterior, lateral, and posterior wall of the right side of the chest. The wad was kept in place by a layer of gauze, and covered with a thick layer of salicylated cotton, over which was placed a large piece of mackintosh. The whole of the dressing was held in place by a piece of cotton cloth, and fixed with roller bandages.

The patient was taken to his bed, and quinia, morphia, and whiskey given.

Dec. 27. Pulse 88; temp. 98°; the patient's breath has no offensive odour; he can lie on his back without coughing; has slept well; has coughed only a little; no bad odour to the sputum. The wound was dressed; the dressings contained a little bloody pus; the cavity was washed out with one per cent. solution of carbolic acid, which made him cough, and forced a jet of fluid from the anterior opening through and beside the tube; the carbolic acid solution passed up into the mouth so that the patient could taste it.

28*th*. Pulse 80; temp. 98.5°. Less pus in the dressings. There is no noticeable offensive odour.

29*th*. Pulse 90; temp. 98.5°. The patient begins to have an appetite, sleeps well, and has very little cough.

The dressings were removed every day. The solution with which the cavity was washed out contained less and less pus.

Jan. 9, 1881. Pulse 108; temp. 98.5°. The water with which the cavity is washed out still has a whitish colour.

17*th.* When water is injected into the cavity, he coughs up part of it, and can taste and smell the carbolic acid.

21*st.* About two ounces of pus found in the discharge. If the patient coughs while an injection is being made, the fluid is ejected with great force through both ends of the drainage tube, from three to six feet in the air. As the cavity was evidently decreasing considerably in size, the axillary portion of the drainage-tube was removed in this way; the whole tube was taken out, cut in halves, and only one-half re-inserted through the anterior opening.

28*th.* No discharge in the dressings. The opening in the axillary region appears to have closed. The anterior opening is closing up fast around the drainage tube. Discontinued the injections into the cavity because it is quite small, and any injection causes great irritation of the bronchi, resulting in paroxysms of coughing. The patient eats well, sleeps well, and his bowels are regular.

Feb. 3. The anterior wound is still open, but the opening is very small.

6*th.* Both wounds are closed. The patient has no cough; appetite good; sleeps well, and is out of bed.

9*th.* The patient caught cold while walking around the corridor yesterday. Has fever, headache, and cough, which caused him to go to bed. Pulse 92; temp. 101.5°. He has no pain in the chest. He has a cough, which is so distressing that it disturbs his sleep. Numerous moist râles are heard all over the right lung and in the lower lobe of the left lung. Ordered quinia, morphia, and the inhalation of carbolic acid spray.

14*th.* Pulse 96; temp. 99.5°. He coughs a good deal and expectorates about a pint of muco-purulent sputum in the twenty-four hours. His appetite is fairly good. Microscopical examination of the sputum shows pus-cells and epithelial cells in a more or less advanced state of fatty degeneration. No elastic lung fibres found. The sputum has no fetid odour. Ordered a respirator, to the anterior side of which is attached a sponge soaked in five per cent. solution of carbolic acid, to be used four or five hours a day.

17*th.* Pulse 102; temp. 99°. Says that the inhalation of the carbolic acid solution makes him vomit.

21*st.* The sputum is still abundant, and moist râles are heard over both lungs.

27*th.* Pulse 84; temp. 98.5°.

Physical Examination, Right Lung.—Over the right clavicular and supra-clavicular fossæ, there is dull percussion, and numerous fine crepitant râles are heard, both with inspiration and expiration. In the infra-clavicular, mammary, and infra-mammary regions, the percussion is normal, crepitant râles spread here and there, accompanying the otherwise normal respiratory sounds. In the supra-spinatus and infra-spinatus regions, the percussion sound is not exactly dull, but less sonorous than on the left side. In the infra-scapular region, percussion is normal. A few spread moist râles are heard all over the posterior surface of the lung. The respiratory sounds are otherwise normal.

Left Lung.—The anterior surface is in every respect normal. On the posterior surface, the upper half of the lung is normal, but in the infra-scapular region, numerous fine crepitant râles are heard, both with expiration and inspiration.

Ordered Griffith's mixture, syrup of morphia, and cod-liver oil, and the continuance of the inhalation of carbolic acid spray from the sponge and by the atomizer. The patient expectorates in twenty-four hours about half a pint of colourless matter, consisting of semi-transparent slimy matter, intermixed with yellow lumps.

March 4. Pulse 72; temp. 98.5°. The dulness in the upper lobe of the right lung is subsiding, so that now the inner half of the right clavicular region gives clear percussion. There is still dull percussion, however, over the outer half of the right clavicular and supra-clavicular regions. The crepitant râles have diminished considerably over the apex of this lung, and have disappeared in the rest of the lung, except at a point corresponding to the lower half of the former cavity; namely, a place in the anterior axillary line between the fourth and fifth ribs, to an extent of one to two square inches.

7th. Very little cough, and this brings up only slimy sputum, not to exceed one to two drachms in the course of twenty-four hours.

15th. Percussion is perfectly normal throughout both the right and left lung. Respiratory sounds are normal, movements of both sides of the chest normal. No atrophy or sinking-in over any part of the right lung. The patient has a very slight cough, with a little grayish-black mucous expectoration, probably from the pharynx or nasal cavity, the colour of the sputum being due to its admixture with dust. No râles in any place in the right lung. He sometimes feels slight pain in the above-described limited space in the right infra-axillary region. Pulse and temperature are normal. Appetite good. He has regained his strength, and looks well nourished and healthy.

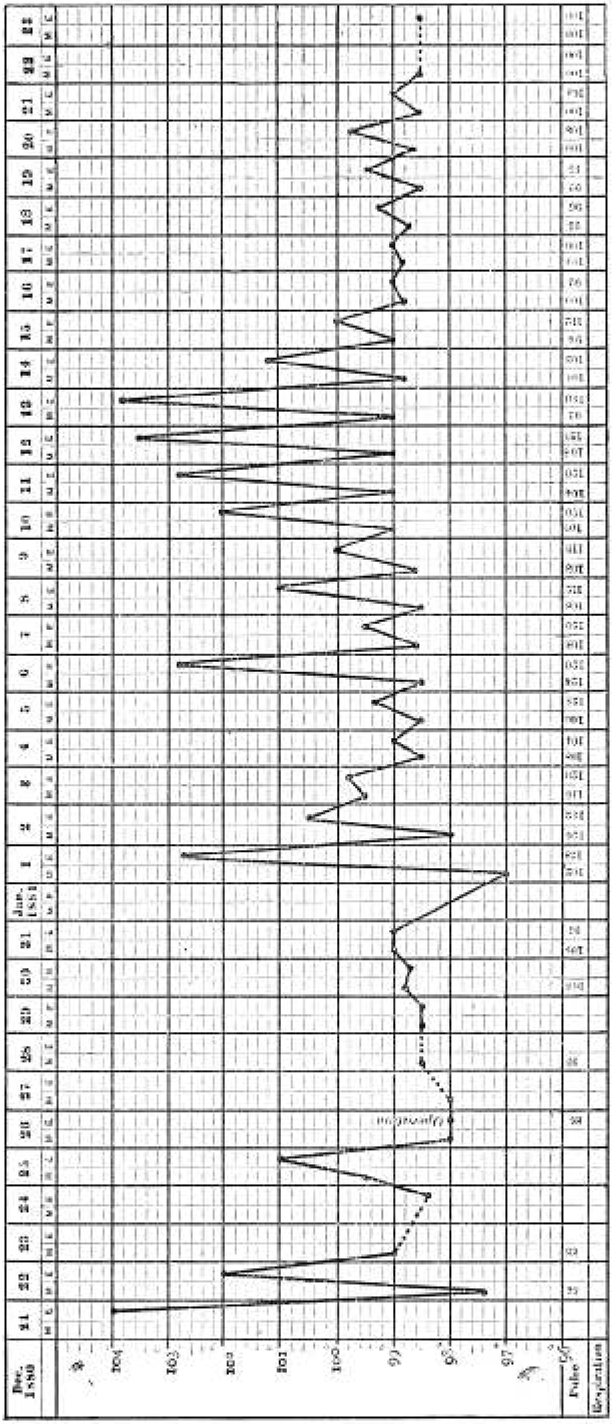
April 7th. The patient was discharged from the hospital, cured.

On the opposite page is a diagram showing the temperature curve of this case.

The first and main question that presents itself in this case is naturally this: Was the disease an ichorous cavity within the lung tissue, or was it a limited pyo-pneumothorax? As the patient did not die, and, as consequently we have no final proof, we must base the diagnosis upon the symptoms as given in the description of the case.

The symptoms, and the whole course of the disease were so exactly congruent with the description and course of echinococcus of the lung as given in *Ziemssen's Encyclopædia* (Parasites of the Lungs, vol. v, p. 462), that the diagnosis might have been made with a very great degree of probability, even before the evacuation and microscopical examination of the cyst. The pulmonary hemorrhage, pain in the affected lung, recurrent attacks of cough, that is, bronchitis, persistent pain, always at the same place, and increased by bodily exertion, all these symptoms increasing slowly during a long series of years, and, finally, the death of the echinococcus and suppuration in and around the sac, form, taken together, the typical course of a large pulmonary echinococcus. But we know that in very rare cases an echinococcus may develop within the pleural cavity.

The alternating dull and tympanitic percussion, according to the dis-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100
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Operation
Pulse
Respiration

placement of the contents of the cavity, is, as is well known, exactly the same in extra-pulmonary as in superficial intra-pulmonary cavities. The position of the cavity, at the anterior half of the middle lobe of the lung, is unusual for empyemas, but, nevertheless, does not exclude the possibility of their presence. The pathological character of the cavity, as a separate echinococcus sac, would favour rather intra-pulmonary than extra-pulmonary location, not only because the embryo echinococcus, in terminating its wanderings from the intestines to its final resting place, is obliged, so to speak, to stop and select this somewhere in the solid tissues of one or another organ, rather than to enter a serous cavity like the pleura, but also because we know that the tissue of the lung is, with the exception of the liver, the most common location for echinococci.

This, however, did not exclude the possibility of our having a pleural echinococcus, and, consequently, an extra-pulmonary cavity to deal with, since there are a few indisputable cases on record, in which echinococci have been found in serous cavities without any visible primary connection with, or development from, the organs belonging to the cavity.

Cobbold describes in his book (Parasites, or the Entozoa of Men and Animals, London, 1879, p. 133), a case in which an echinococcus sac was found between the liver and diaphragm, having no apparent connection with any of the organs. Cases of similar echinococci in the pleural cavity are also on record, but these are very rare.

The only physical sign which, in the opinion of the authors, enables us to make a differential diagnosis between an extra-pleural and an intra-pleural cavity, communicating with the bronchi, and filled partly with fluid and partly with air, is the pectoral fremitus. We formerly believed that on the wall of the chest over an extra-pulmonary cavity, we should find the pectoral fremitus absent, and that on the wall of the chest over an intra-pulmonary cavity, we should find it increased in intensity. This doctrine is undoubtedly correct as far as consumptive cavities are concerned, but it seems to be open to doubt whether it is the same in cases of abscess or gangrenous cavities, as in Smith's and in our own case the pectoral fremitus over the cavities was lessened, but not absent. In Simpson's description of the symptoms of echinococcus, he states that the vocal fremitus is diminished.

The cavernous breathing and tympanitic percussion sounds are common to both extra-pulmonary and intra-pulmonary cavities, and even the sudden and violent ejection of the contents of the cavity through the wound of operation, may occur in an extra-pulmonary cavity, when the communication with the lung tissue and bronchial tubes is sufficiently large to admit of the free passage of air from the bronchi, during expiration and cough.

As it is sometimes so difficult to make a differential diagnosis by the physical signs alone, this task may be rendered more easy by taking into consideration the whole development and course of the disease.

In a case like Smith's, for instance, where subsequent to an attack of croupous pneumonia, the resolution of the peripheral area of which has taken place, and then gangrene set in, in a part of the lung over which the percussion is clear, and in which the breathing has gradually become cavernous, the diagnosis presents, of course, no peculiar difficulties. In other cases, as our own, for example, the differential diagnosis may be difficult, if not impossible up to the time of the operation, during which it is possible that the examination of the cavity with the finger, that is, the palpation of its walls, may enable us to ascertain the nature of the cavity. In our own case, any doubt which might have existed as to the intra-pulmonary character of the cavity was dispelled by the examination with the finger, which showed that soft lung tissue formed the lower, inner, and outer wall of the cavity. If the echinococcus had been developed in the anterior part of the pleural cavity, it would have pushed the anterior border of the lung, together with the lung itself, backward, and no lung tissue would have been found on the interior wall of the cavity.

A number of very important questions naturally present themselves whenever a new and somewhat radical treatment is entered upon in a class of diseases which have not been hitherto treated by direct surgical interference. The number of these questions still to be answered is so much the larger, as the cases, as yet on record, are comparatively few.

We shall endeavour to enumerate these questions, and point out the direction in which future investigations will have to be made, with a view of bringing them nearer to a solution. We shall therefore consider fully the following three points: The indications for the operation, the operation itself, and the after-treatment.

I. *Indications for the Operation.*—What cases of acute pulmonary cavities require or may be benefited by opening and drainage? In examining this question, we must consider not only the possibility of, but also the frequency with which acute cavities of the lungs, abscesses of course, rather than gangrenous cavities, have been known to terminate in spontaneous recovery. It will consequently never be advisable to operate at a very early stage of such a cavity, when the general condition of the patient may lead us to expect a spontaneous recovery by evacuation through the bronchi. On the other hand, to wait until the patient has been brought down to the very limits of vital power would be to press the expectant treatment too far. In Radek's case, the operation was evidently performed too late.

On reviewing the other cases on record, we think the operation is justifiable in any case where the presence of a gangrenous or ichorous cavity having been ascertained, it is found that, notwithstanding an outlet through the bronchi for a portion of the contents of the cavity, it steadily fills up again; the partial evacuation does not relieve the patient, who gradually loses strength, and progresses toward a condition of collapse; a steady or intermittent rise in temperature continues; the infection of the healthy portions of the lung from the decomposed contents of the cavity has commenced, or is evidently about to take place; the breath and expectoration continue fetid; absence of appetite; increasing weakness, with or even without fever, etc. These indications will enable any medical man of some clinical experience to determine, in the majority of such cases, when the disease has reached a point from which spontaneous recovery is impossible.

Is the cavity so situated that we can get at it from the outside, and is the pleural cavity covering it obliterated by adhesions, so that we do not run any risk of causing a fetid pyo-pneumothorax by opening into the cavity and allowing decomposed matter to enter the pleural cavity? In answer to the first part of this question, we may say that any cavity covered by the scapula, or situated within the supra-clavicular and infra-clavicular regions may at present be regarded as inaccessible. But from the mammary and axillary regions downward, as well as in the infra-scapular region, the anatomical conditions of the wall of the chest do not prevent access to the cavity. Regarding the second part of the question, namely, the obliteration of the pleural cavity covering the field of operation: Such adhesions are to be expected in cases in which the superficial area of the cavity is large, or more frequently, in which several attacks of the disease have occurred in that portion of the lung where the cavity forms, constituting in all probability the primary cause of the gangrene or suppuration, both of which, as is well known, do not set in primarily, but are consecutive or secondary to a number of different primary pathological conditions of the lung tissue.

In many cases it will be impossible to ascertain whether or not these adhesions exist, and to be sure on this point, we shall recommend the procedure employed in our own case. Make an incision down to the intercostal muscles, pass a needle into the lung, and watch the needle during the phases of respiration. If it does not move synchronously with the respirations, we may be sure that at this place there are adhesions between the layers of the pleura, and may consequently cut in without fear. If the needle does move, we can abandon the operation if we choose, since the small primary incision, as well as the puncture with the needle or plastic pin, if covered by antiseptic dressing, will do the patient no harm.

A question yet to be determined is, whether the operation had better be abandoned when the needle moves and the pleural cavity is consequently known to exist. Smith makes a remark in regard to this point, with which we might theoretically feel inclined to agree; that the tapping of a progressive gangrenous cavity through a pleural cavity not yet obliterated, would appear only to hasten by a little what would inevitably soon occur of itself, namely, the formation of a fetid pyo-pneumothorax. There is, however, the compensatory advantage that the incision which caused this empyema, is the most essential for its relief.

This is an open question, however, and the ground is very dangerous, as we know that such openings of still healthy pleural cavities have caused rather sudden and possibly inevitably fatal results.

As a last point in the indications for the operation, or rather as a preparatory measure, before the operation is resorted to, we should recommend that one or two exploratory aspirations be made with a hypodermic syringe, in the place in which the physical signs may lead us to locate the cavity about to be operated upon. This exploratory aspiration, when fetid matter is brought out from the cavity, not only furnishes us an unmistakable proof of the correctness of the diagnosis of a cavity filled with fetid matter, a mistake in the diagnosis of which would prove a very disagreeable surprise during the progress of the operation, but it may also give us some idea as to the situation of the cavity beneath the surface.

II. *The Operation.*—The operation having been decided upon, the first question is: Where shall the opening through the wall of the chest be made? or rather: At what point shall we cut in? In cases in which the cavernous symptoms are limited to a single small spot of the thorax, the place of incision shows itself easily enough, as the choice of necessity. But cases may occur, like Smith's, for instance, where the cavity comes to the surface at different or distant places. It has been suggested that in such cases, the general rules for the opening of abscesses should be followed out, namely, that the lowest point, the point nearest to the bottom of the cavity, should be selected as the place most favourable for the escape of its contents through the drainage tubes.

As the local and general condition of the patient to be operated upon will not enable him to be out of bed, and as the recumbent position will consequently be necessary, it would seem desirable to select a place for the incision as near the posterior and inferior surface of the cavity as possible. The posterior wall of the thorax has, however, this disadvantage, that the intercostal spaces here are narrower than on the anterior wall of the thorax, and that, consequently, not only the introduction of a sufficiently large tube may be difficult, but the introduction of the finger for exploring the cavity may be entirely impossible, unless resection of a portion of one of the ribs is resorted to. That the latter procedure is not very dangerous in itself we know from operations for empyema, and in case of necessity we shall not hesitate to resort to it. But the excision of a piece of a rib may cause suppurative periostitis and necrosis, and should consequently be avoided when not absolutely necessary.

The most natural way of solving the problem of the place for opening pulmonary cavities seems to us to be the following: Be guided as far as possible by the common law for the opening and evacuation of abscesses in any other part of the body, that is, make two openings; the first or primary opening in the most superficial and in other respects most easily accessible place to the cavity, then explore the cavity, and by this exploration try to ascertain the deepest point which will allow of a counter-opening being made in the most favourable and safe place, for, as nearly as possible, the complete evacuation of the contents of the cavity.

In our own case this plan proved eminently satisfactory, and the existence of two openings instead of one was not only not accompanied by the slightest disadvantage in any way, but, in our opinion, facilitated greatly the evacuation and cleansing of the cavity.

When there is only one opening into a cavity, the evacuation may be perfect; but thorough washing out, even through a double catheter or tube is, for reasons too obvious to mention, not as efficient as when two openings have been made.

Washing out through a single tube, as has been done in most of the previous cases, causes, from distension of the walls of the cavity and irritation of the bronchial tubes by the fluid injected, so much irritation and so violent a cough, that Mosler, Williams, and Lyell were obliged to abandon the injections as too irritating to the patient.

When these authors go a step farther, and say that injections into the cavity are not all necessary, because the symptoms are relieved and the fetor is stopped by the simple drainage of the cavity, we must say that the facts from the cases recorded do not quite corroborate this assertion, as neither in Smith's nor in Powell and Lyell's case was the fetid condition of the contents of the cavity entirely overcome by the operation alone.

Taking into consideration the fact that in all cases previous to our own, only one opening had been made, and only a single drainage-tube employed, it is very probable that to the drainage and cleansing of the cavity by means of the double opening in our own case, is to be attributed the instant and permanently perfect result as regards the disappearance of the fetor.

Having thus decided where to cut down upon the cavity, we make an incision, one to two inches in length, in the middle of the intercostal space, parallel to the ribs, down to the intercostal muscles or pleura, ligating any vessels met with. A somewhat free incision is liable to prevent general subcutaneous emphysema from setting in. This does not seem to be very dangerous, however, as in Williams's case, in which the air contained was fetid, no inflammation occurred and the emphysema disappeared.

The next point is how to make the opening through the pleura or rather the lung tissue which possibly forms the peripheral wall of the cavity. We must remember that the lung tissue of the wall of the cavity, which we have to cut through, may contain arterial or venous pulmonary branches, sufficient in size to cause a considerable and very undesirable hemorrhage, which in this place, it might be difficult if not impossible to control. We therefore agree with Lyell and Smith that it is not desirable to make too free use of the knife here, or, as Sutton describes it, to "plunge" a knife into the cavity. A punctured opening should rather be made with a medium sized trocar, and this opening dilated by blunt instruments as, for instance, a dressing forceps, sufficient to admit either, as the above author states, a sufficiently large drainage tube, or rather, as we should not hesitate to propose in any case, to admit a finger for the exploration of the cavity.

The exploration of the cavity with the finger serves a double purpose: First, to find a suitable place, at the lowest possible part of the cavity, at which a counter-opening may be made safely, that is, without cutting through too much lung tissue or into the pleural cavity; and, second, to ascertain by touch, the presence of free sequestrated pieces of dead lung tissue, with a view to their removal. This latter is mainly of importance in gangrenous cavities. In circumscribed gangrene of the lungs, a piece of dead lung tissue of the size of a walnut may be found (Rokitansky, *Pathological Anatomy*, Sydenham Soc.'s Edition, vol. iv. p. 96). The removal of this is of course essential to the stoppage of the fetor and of the possible infection of the rest of the lung.

That such a piece of gangrenous lung tissue can be successfully removed, and the patient recover, has been demonstrated in a case of gangrenous pleurisy, reported by Wagner (*Berliner Klinische Wochenschrift*, Sept. 6, 1880, p. 511), in which by an opening through the empyema, a piece of gangrenous lung tissue, seven centimetres long and three centimetres broad, was removed, after which the fetor immediately stopped, and the patient finally recovered.

The next important point to consider is with what kind of drainage-tube the most efficient drainage of the cavity may be accomplished. Mosler used a silver tube. In all the other cases, rubber tubes have been used, but Lyell advocates the silver tube with a shield with which to strap it to the chest, in the same way as the canula for tracheotomy. In our opinion, metal, hard rubber, or any tubes of hard material are dangerous, because there will always be a possibility of hemorrhage into the cavity, caused by ulceration of a vessel in the wall of the cavity from rubbing against the hard tube.

That ulceration and fatal hemorrhage may take place in this way we know from cases of fatal hemorrhage caused by usura of vessels from rubbing against calcareous deposits, the so-called "lung stones," in small pulmonary bronchiectatic cavities, which were healing, but in which, for some reason, the irregularly shaped lung stones were not evacuated through the bronchi, but remained in the cavity. Consequently we prefer soft material, as flexible India-rubber, for drainage tubes for use in lung cavities.

In cases in which it is impossible to make more than one opening into the pulmonary cavity, we recommend the use of a double, soft rubber, drainage-tube, which is easily made by cutting the necessary openings in the walls of the tube, and bending it in the middle, so that one hole shall be at the bottom of the tube when bent, and several openings on either side of the double tube. This may then be sewed together, and the tube is ready for insertion.

In the cases previously referred to, in which only one opening was made, a single tube was always used, and the drainage was insufficient, because the fetor was not permanently overcome, and the washing out was very irritating, for the reasons stated above.

When two openings can be made into the cavity, we advise that the method employed in our own case be followed out, namely, to introduce a large, soft rubber drainage-tube through one opening and lead it out at the other. To prevent these drainage tubes from slipping in or out of the cavity, we recommend the use of a disinfected safety pin passed through the peripheral ends of the tube. If thought necessary, this pin may be easily secured by straps around the chest, and the tube cut off just beyond the pin.

The washing out of the cavity can be effected without much irritation to the patient, by means of a double drainage tube when there is only one opening or of a single perforated tube when there are two openings, provided the fluid is not injected too vigorously.

The thorough washing out of the cavity is important as long as any fetor remains. With what solution this should be accomplished is an open question. Lyell used Condy's fluid; Smith, a solution of carbolic acid of unknown strength, and in our own case, we used for the first irrigation a two and one-half per cent. solution of carbolic acid; later, a weaker (about one per cent.) solution, and finally, when no fetor was perceptible, either in the discharge or breath, a solution of thymol of the usual strength was employed.

There is no doubt that the carbolic acid is the most efficient as a disinfectant, but there is always some danger of carbolic acid poisoning when we have to wash out a cavity under such conditions that we cannot be sure of removing the whole amount of the fluid injected. For this reason, we recommend the following plan for the washing out of fetid lung cavities: Commence to wash out with a two and one-half per cent. solution of carbolic acid; follow this either with a weaker solution or with thymol solution of the usual strength. Let this procedure be repeated at each successive washing out of the cavity until the fetor entirely disappears, and then use the innocent thymol solution as long as there is any considerable discharge from the cavity. When the discharge stops, discontinue the injections.

The dressing of the lung operated upon should consist of voluminous antiseptic dressings; namely, a wad, two to four inches thick, of Lister's gauze, surrounded by a layer of salicylated cotton, one to two inches in thickness; the wad of gauze and cotton should cover the entire side of the chest; over this should be placed a large piece of mackintosh, and outside of this, a set of roller bandages should be applied, to keep the dressings in place.

III. *After-treatment.*—The dressings should be changed as often as may be necessary, according to the amount of the discharge. Smith had the dressings changed every three hours. In Lyell's and also in our own case, the dressings were changed every twenty-four hours. We do not recommend the removal and change of the dressings oftener than once in twenty-four hours, except when the discharge is so copious as to soak entirely through the bandage. Frequent changing of the dressings disturbs the patient, who needs rest.

The medical treatment is simply symptomatic; quinia, when there is a rise in temperature; morphia or opiates for the cough; wine and other alcoholic stimulants to keep up the strength, and nourishing food of any kind, as much as can be taken, are all indicated.

The drainage-tube should be removed when the cavity has filled up, and retracted so as not to retain any fluid in the edges, and when, consequently, the discharge has stopped.

It is important not to remove the drainage-tubes too early, because the external openings are liable to close up before the cavity is closed, as we know from Lyell's case, in which the re-introduction of a drainage-tube that had slipped out was made difficult by encroaching granulations in the canal leading to the cavity, and as we know from general experience from old empyemic fistulæ. In our own case, we think that the drainage-tube was removed too early, and that this mistake placed the patient's life in jeopardy. It will be seen from the history of our own case, that after the removal of the drainage-tube and the closing of the external wound, when we thought everything safe and all right, and the patient was allowed to be up and around, suddenly diffuse bronchitis and broncho-pneumonia set in in the whole upper lobe of the affected lung, and bronchitis in the lower lobe of the other lung. When this serious complication set in we were convinced that it originated from aspirated matter, from the not yet fully closed pulmonary cavity, notwithstanding the absence of any physical signs indicating such a condition of the cavity, and we watched the case from day to day, seriously contemplating the re-opening of the anterior wound and re-entrance to the cavity, if the general condition of the patient should not improve within a few days. The operation, however, did not take place, as the bronchitis and pneumonia subsided under general treatment, combined with inhalations of carbolic acid through a steam atomizer and sponge. Thereafter, recovery was uninterrupted and perfect.

The secondary bronchitis and broncho-pneumonia is undoubtedly the main danger we have to encounter during the course and after-treatment of cavities in the lungs, whether surgical treatment has been resorted to or not. It was found to be the cause of death in Lyell's case; it jeopardized the recovery in our own case. In Smith's case no post-mortem examination was made, and in Sutton's and Williams's cases, the records are not sufficiently explicit to throw any light upon this subject.

But from the slight amount of material existing, it seems evident that this bronchitis and broncho-pneumonia is an essential complication of cavities in the lungs, distinguishing such cavities from fetid intra-pleural cavities and empyemas, and gives an interesting hint as to the importance of effective surgical treatment.

In conclusion, we shall say that the whole subject of the surgical treatment of intra-pulmonary cavities is so new, and the important questions as to all the details so many, that our paper of to-day cannot be considered as attempting to solve any of these questions definitely.

As to the practical value of the operation, the objection might be, and has lately been made, that the number of cases in which this treatment may be indicated is very small. From a scientific and even from a humanitarian point of view, this objection, it is needless to state, is entirely valueless.

That this new field of surgery deserves to be entered upon and have a fair trial is beyond question, not only from a practical point of view, as a temporary relief has been obtained in most of the cases on record, and a permanent cure in our own case, but also from a scientific point of view, as the procedure we have advocated is entirely rational, that is, in conformity with the physiological and pathological facts and laws governing the diseases in question.

We finally hope and trust that our case and our remarks may encourage other members of our profession to take the matter in hand and contribute to the solution of this problem, which even if only occasionally, certainly may save a human life, otherwise irrevocably lost.

120 W. INDIANA ST., CHICAGO, ILLINOIS.

ARTICLE VI.

HYSTERO-EPILEPSY. By CHARLES K. MILLS, M.D., Neurologist to the Philadelphia Hospital; Lecturer on Mental Diseases and Electro-Therapeutics in the University of Pennsylvania.

FRENCH authors distinguish two forms of hystero-epilepsy: (1) Hystero-epilepsy with separate crises, in which the symptoms of hysteria and of epilepsy appear completely independent of each other, and in attacks perfectly distinct; (2) Hystero-epilepsy with combined crises, in